

CONTINUOUS FIBER CERAMIC COMPOSITES

Project Fact Sheet



CFCC HEAT TREATING FURNACE FAN

BENEFITS

Industries that use CFCC components in their applications will realize substantial energy, environmental and financial benefits, including higher efficiency, lower maintenance, and decreased operating costs. CFCC heat treating furnace fans provide:

- improved corrosion and creep resistance resulting in significantly longer life and reduced furnace down time
- lighter weight construction resulting in easier installation, less maintenance and reduced energy consumption
- higher temperature capability resulting in greater durability and allowing removal of ancillary cooling equipment
- higher temperature capability enabling increased processing temperature to be attained, improving process efficiency

APPLICATIONS

The CFCC furnace fan can be used in metal processing or glass heat treating furnaces to recirculate air. The fan can also be used in chemical plants to circulate corrosive gases and in the steel making process to circulate hot particle laden exhaust gases. The CFCC furnace fan application provides an excellent market entry component that has a good probability of success due to the potential ease of manufacture and the low implementation and commercialization risk.



POLYMER IMPREGNATION AND PYROLYSIS (PIP) PROCESS USED TO FABRICATE CFCC HEAT TREATING FURNACE FANS

The U.S. Department of Energy's Office of Industrial Technologies (OIT) initiated the Continuous Fiber Ceramic Composite (CFCC) Program in 1992 as a collaborative effort between industry, National Laboratories, universities and government.

Through support of the CFCC Program, Dow Corning Corporation has developed a versatile polymer impregnation and pyrolysis (PIP) process to fabricate complex-shaped ceramic composites. The PIP process offers significant flexibility in comparison to other ceramic composite fabrication processes. The process uses low-temperature forming and molding steps typically used in the fabrication of polymer matrix composites.

Dow Corning Corporation in collaboration with Surface Combustion, Incorporated is developing a CFCC fan for application in metal heat treating furnaces. The furnace fan has been identified as a unique technology that may bring many economic and environmental benefits. Key features of the CFCC furnace fan include reduced weight, increased corrosion and creep resistance, and reduced thermal inertia. These characteristics will ease installation and replacement, allow higher operating speeds for improved life, and increase the temperature capability to allow higher processing temperatures and eliminate ancillary cooling equipment.

FURNACE FAN BLADE



CFCC fan blades (individual blade shown above) help provide operational and energy efficiency advantages in heat treating.

Project Description

Goal: The goals of this project are to: 1) optimize the long-term, high temperature durability of CFCC materials for application in heat treating furnaces; 2) utilize cost-effective raw materials and processing; and 3) implement and evaluate CFCC PIP furnace fans for metal heat treating furnaces.

As exhibited by this project, the CFCC Program is addressing the critical need for advanced materials that are lighter, stronger, and more corrosion-resistant than metals. The Program strives to advance processing methods for reliable and cost-effective ceramic composite materials to a point at which industry assumes the full risk of development and commercialization. The long-term strategy is to develop the primary processing methods for reliable and cost-effective fabrication of CFCCs and to perform application-specific testing which will meet the needs of a wide range of energy saving applications in industry. These industries include: power generation, agriculture, aluminum, steel, chemicals, forest products, glass, metal casting, mining and refining.

Progress and Milestones

- The initial feasibility work for the CFCC furnace fans was performed by Amercom, Surface Combustion, and Material Science Corporation. This work resulted in a fabrication development, finite element analysis and a blade design that meets the requirements of the application. The selected design integrated CFCC fan blades with a modified metallic attachment scheme.
- Dow Corning Corporation fabricated CFCC prototype fan blades using a polymer impregnation and pyrolysis (PIP) process.
- CFCC furnace fan blades will be fabricated for Surface Combustion to proof-test and then install them into a metal heat treating furnace for a field evaluation.
- CFCC coupons are being exposed for six months in a heat treating furnace that is used for carburizing metal components to verify durability in this environment.



PROJECT PARTNERS

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